

Section 7.16

Forest Management

(October 2006)

EMISSION INVENTORY SOURCE CATEGORY

Miscellaneous Processes - Managed Burning and Disposal - Forest Management

EMISSION INVENTORY CODES (CES CODES) AND DESCRIPTION

670-666-0200-0000 (47274) Forest Management

INTRODUCTION

Emissions reported here are exclusively for prescribed burn events in the San Joaquin Valley Air Basin (SJVAB) in years 2000, 2001, 2002 and 2003.

CATEGORY DESCRIPTION: The Forest Management categories include emissions from management burns, also known as prescribed burn (Rx) or broadcast burns. This inventory also includes range improvement type burns. A prescribed burn is a fire ignited by a planned management action, and most often administered by a public land management agency. A prescribed fire can burn a variety of fuel types including forest vegetation, grass, and brush. Although pile burning is part of the forest management category, pile burn emissions are omitted from this inventory update due to lack of information. The emissions reported in this category do not include activity from agricultural related burning, wildfires, or wildland fire use (WFU) fires because these categories are covered under other emission inventory categories (EIC). A WFU is a naturally ignited lightning fire managed for resources benefit.

EMISSION ESTIMATION METHODS

EMISSION ESTIMATION SYSTEM (EES) MODEL: Prescribed burn emissions are calculated using the Geographic Information System (GIS) based Emission Estimation System (EES) model. The EES implements the Forest Service First Order Fire Effects Model (FOFEM 4.0) methodology to calculate emissions. Known fire perimeters are overlaid on the California GAP landcover vegetation layer, establishing the acres of the specific vegetation burned in each fire, then fuel loading characteristics are assigned to each vegetation type. The EES then calculates the tons of fuel consumed by the fire and applies the appropriate emission factor to generate smoke emissions per prescribed burn event. In the case of CO₂, emissions were estimated externally because the EES model does not include CO₂ emission factors.

The EES model was developed for ARB by UC Berkeley's Center for the Assessment and Monitoring of Forest and Environmental Resources (CAMFER) laboratory. For more information about the EES model, go to:

<http://www.arb.ca.gov/ei/see/see.htm>

EMISSION FACTORS: Emission factors for PM10, PM2.5, and CO were initially published by FOFEM. In 2001 the CAMFER lab, via ARB contract, expanded the suite of emission factors to include NOx, SO2, N2O, NH3, CH4, and TNMHC. The CO2 emission factors were taken from the Ward and Hardy 1991 report, as published in the 2003 CAMFER report. Emission factors are characterized by ten different fuel components that comprise a vegetation landcover, including duff, litter, wood 0-1 inches in diameter, wood 1-3 inches in diameter, wood 3+ inches in diameter, litter, herbaceous, regeneration, lateral fuels, and canopy fuels. For additional description information on the fuel components, or to download the CAMFER reports and other background information, go to:

<http://www.arb.ca.gov/ei/see/see.htm>.

ACTIVITY DATA: Prescribed burn data was collected from a variety of sources, including the National Park Service (NPS) clearinghouse, the California Department of Forestry (CDF) Fire and Resources Assessment Program (FRAP) clearinghouse, and the National Forest Service (NFS) National Fire Plan Operations and Reporting System (NFORS) clearinghouse. In most cases land management agency staff was contacted for additional information and/or for data clarification. There are several public land management agencies in the SJVAB that have prescribed burn programs, including CDF, Sierra National Forest, Inyo National Forest, Sequoia National Forest, Sequoia/Kings Canyon National Park, and Yosemite National Park. All this data collected was in GIS format. These sources reported 37 prescribed burn events in the SJVAB for the years 2000 through 2003, totaling approximately 19,040 acres.

In addition, the SJV district staff provided several prescribed burn events that were managed by non land management agencies such as the Lawrence Livermore National Laboratory and Southern California Edison. The activity provided by the District included forest burning as well as range improvement burns. Range improvement burn emissions have historically been in a separate EIC category; however, since both categories use the same emission estimation methods and the District permit program does not differentiate between the two types of burns, they are rolled into the Forest Burn category.

The District information provided the county, a date, the acres burned and a general description of the vegetation, such as grass or brush, for each event. For these data, emissions were calculated by cross walking the reported vegetation to vegetation specific emission factors and fuel loading factors derived from EES runs. To briefly elaborate on how this was done, the EES model was run for each vegetation model in California using the typical prescribed burn conditions listed above. Then weight averaged emission factors and fuel

loadings for each vegetation fuel model were calculated from the detailed EES output table. These data were cross walked to the District burn data based on the vegetation description provided. The District reported an additional 10 prescribed fire burn events for 2000 through 2003, totaling 5,470 acres.

All combined, there were a total of 47 prescribed burn events in the SJVAB for the years 2000 through 2003. The total area burned was approximately 24,510 acres. Table 1 below summarizes the distribution of acres burned by county and year.

Table 1. San Joaquin Valley Air Basin 2000-2003 Prescribed Burned Acres by County*

	2000	2001	2002	2003
Fresno	1,872	1,101	1,401	1,428
Tulare	3,344	1,670	3,724	3,394
Stanislaus	100	485	0	0
Madera	345	0	80	0
King	0	0.0	140	767
San Joaquin	0	1,772	1,195	1,303
Merced	0	0	387	0
Total	5,661	5,028	6,927	6,892

*There were no prescribed burns in Kern County.

PRESCRIBED BURN CONDITIONS: Most managed burns intentionally meander across the forest floor only burning a portion of the fire footprint. It is common for a prescribed burn to miss areas within the prescribed burn perimeter and create islands of unburned vegetation. Based on discussions with SJV District and National Park Service prescribed burn staff, it is estimated that on average about 60% of the prescribed fire footprint is burned.

Where GIS shapefiles were collected from land management agencies and or their clearinghouses, 60% of the EES model output emissions are reported as the final emission estimates to account for the irregular coverage of prescribed fire. In the cases where the SJV District staff provided the burn information in a flat file, the 60% area burned was already accounted for in the reported acres, therefore, 100% of the EES output emissions are reported.

For prescribed burn emissions, the model was run assuming a moderate moisture condition, no crown fire, and a 15% national fire danger rating - thousand hour fuel moisture (NFDR-TH). Fuel densities were assumed to be "typical." Figure 1 below is a print screen of the EES model input form showing the parameters for the prescribed burns. These typical prescribed burn conditions were also verified as representative model inputs by the SJV District and National Park Service prescribed burn staff.

Figure 1. Prescribed burn parameters shown in the EES model inputs form

SUMMARY OF SJVAB PRESCRIBED BURN EMISSIONS

Table 2 below provides a list of 2002 prescribed burn emissions by pollutant and the acres burned in the SJVAB counties. Although years 2000, 2001 or 2003 are not listed here, they can be found in the ARB's California Emissions Inventory Development and Reporting System (CEIDARS).

Table 2. San Joaquin Valley Air Basin 2002 Activity (acres/year) and Emissions by Pollutant (tons/year)

	Fresno	Tulare	Madera	King	San Joaquin	Merced	Total
Activity (acres/year)	1,401	3,724	80	140	1,195	387	6,930
PM10 (tons/year)	397	558	2	1	6	2	970
PM2.5	337	474	2	1	5	2	820
CO	3,936	5,499	20	7	56	18	9,540
CH4	157	220	1	<1	2	1	380
TNMHC	276	385	1	1	4	1	670
NH3	39	55	<1	<1	1	<1	95
NOx	118	172	1	<1	2	1	290
SO2	36	53	<1	<1	1	<1	90
N2O	7.0	10	<1	0	<1	0	17
CO2	49,840	72,262	359	83	704	228	123,480

TEMPORAL DATA

Prescribed burns are most commonly ignited in the spring and fall seasons. Table 3 below shows the percent distribution of acres by month in the SJVAB for 2000-2003 fires.

Table 3. Percent Acres Burned per Month*

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2%	2%	2%	20%	8%	18%	1%	1%	16%	29%	2%	1%

* Numbers may not add up to 100% due to rounding.

Prepared:
October 2006
Neva Sotolongo-Lowery
Emission Inventory Branch, PTSD